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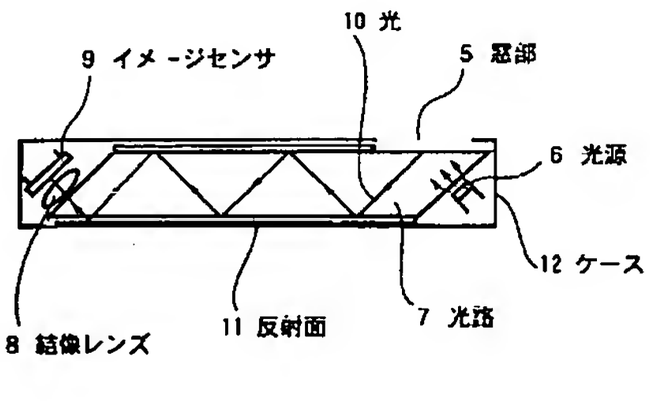
(54)【発明の名称】　イメージスキャナ

(57)【要約】
【課題】指紋等の画像読取りに必要な光路長を確保しつつ、携帯にも便利な薄型のイメージスキャナを実現する。
【解決手段】光源６から窓部５に照射された光は窓部５に当てられた読取り対象の情報を持って反射し、透明ブロックから成る光路６の上下面に形成された反射面１１によって反射されながら導かれ結像レンズ８によってイメージセンサ９状に結像される。薄型のイメージスキャナを実現できる。



【特許請求の範囲】
【請求項１】読取り対象に照明光を照射する光源と、読みとり対象からの反射光を受光し電気信号に変換するイメージセンサと、前記反射光をイメージセンサに結像させる光学系と、イメージセンサから読み出された信号を記憶する記憶手段と、前記照明光源、記憶手段等を制御する制御手段と、上下面のうち少なくとも読取り対象を当てる窓部を除く部分を反射面とした光学的に透明なブロック平板からなる光路とを有し、前記窓部において反射してブロック平板内部に戻った光がブロック平板の上面及び下面の反射面で反射を繰り返しながら伝搬して前記光学系に導かれることを特徴としたイメージスキャナ。
【請求項２】前記光学系の光路を構成する透明なブロック平板をプラスチックで形成したことを特徴とする請求項１に記載のイメージスキャナ。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は、読みとり対象からの反射光をイメージセンサにより電気信号に変換し、その信号を用いて読みとり対象のデータを認識するイメージスキャナに関する。
【０００２】
【従来の技術】光学文字読み取り装置、バーコードリーダ、指紋認識装置などの画像認識装置は、照明光源、結像用レンズ、及びイメージセンサを有し、読み取り対象を適当な倍率で正しくイメージセンサ上に結像させるように配置している。
【０００３】図６に上記従来の画像認識装置の中でも比較的小型に作られた指紋認識装置の光学系の構成を示す。６は光源である照明用ＬＥＤ、１３は光路を曲げるためのプリズム、８は結像用レンズ、９はイメージセンサ、１４は指紋認識の対象である指をそれぞれ示す。光源６はプリズム１３上の指紋を読みとる部分を均一に照明する。この照明光の反射の状態が指紋の凹凸によって変化するが、それを結像レンズ８でイメージセンサ９上に結像することによって指紋情報を採取する。
【０００４】
【発明が解決しようとする課題】通常、指紋等の読取り対象の大きさに比べイメージセンサの大きさは数分の１から数十分の１であるため、適当な倍率で縮小してイメージセンサに結像しなければならない。レンズとイメージセンサの間隔を極端に短く取ることは設計上困難なため、十分な縮小倍率を得るためには、指紋読取り位置とイメージセンサの間に十分な光路長が必要となる。この結果、図６のような構造では、装置の厚さ、幅ともに大きくなり、携帯にも不便なため、用途も限定されてくる。本発明は、かかる従来の画像認識装置の技術の現状に鑑みてなされたものであり、その目的は上記のような欠点を解消し、用途を広げるカード状の薄いイメージスキャナを提供することにある。
【０００５】
【課題を解決するための手段】本願請求項１の発明は、読取り対象に照明光を照射する光源と、読みとり対象からの反射光を受光し電気信号に変換するイメージセンサと、前記反射光をイメージセンサに結像させる光学系と、イメージセンサから読み出された信号を記憶する記憶手段と、前記照明光源、記憶手段等を制御する制御手段と、上下面のうち少なくとも読取り対象を当てる窓部を除く部分を反射面とした光学的に透明なブロック平板からなる光路とを有し、前記窓部において反射してブロック平板内部に戻った光がブロック平板の上面及び下面の反射面で反射を繰り返しながら伝搬して前記光学系に導かれることを特徴としたイメージスキャナである。
【０００６】すなわち、光学的に透明で上下面が平行な反射面をなすようなブロック平板を光路として用いることによって、反射光を折り返しながら受光部に伝えることで、縮小光学系に必要な所望の光路長を全体として確保しながら、装置の薄型化を実現することを特徴とするものである。なお、請求項２の発明は、前記光学系の光路を構成する透明なブロック平板をプラスチックで実現したことを特徴とする請求項１に記載のカード型イメージスキャナである。
【０００７】
【発明の実施の形態】この発明の実施例について図１を参照して説明する。図１の（Ａ）はこの実施例であるカード型イメージスキャナの平面図、（Ｂ）は側面図である。図１において、１はカード本体、２はカード内部の光学系部、３は処理回路部、４はインタフェース部を示す。
【０００８】図２は図１（Ａ）における光学系部２のａ－ａ’断面を示す。光学系部２は光源６、光路７、結像レンズ８、イメージセンサ９から構成され、その周囲をケース１２が覆っている。ただし窓部５においては、光路７がケース１２によって覆われることはなく外部に露出している。光源６は面照明に用いるアレイ状のＬＥＤからなる。光路７は光学的に透明なプラスチック（たとえばＰＭＭＡ）のブロック平板で構成され、その内部に光線を良好に通す。また光路７を形成するプラスチック平板の上下面は、窓部５にあたる部分を除いて、金属蒸着膜等で形成された反射面１１で覆われ良好な反射面を形成している。そして、プラスチック平板の窓部に当たる部分、および光源６とレンズ８に対向する面は、いずれも金属膜による表面処理は行わず平面加工のみのむき出しの状態である。
【０００９】光源６であるＬＥＤからでて光路７のプラスチックに入射した光１０は窓部５を均一に照明する。窓部５のプラスチック表面には読みとり対象がおかれる。この窓部において光１０が反射するが、その際、後述するような光学的メカニズムによって所望の情報を反

射光のパワー分布として反映し、さらに光路７の上下面で反射を繰り返しながら光路内部を導かれ、結像レンズ８によって所定の倍率で縮小されてイメージセンサ９上に結像する。ただし図では、窓部で反射する光１０はその光軸の１本のみで代表している。

【００１０】イメージセンサ９は２次元状に光電変換素子を配列したＣＣＤセンサやＭＯＳセンサ等である。イメージセンサ９に結像した光はその強弱の分布に応じて電気信号に変換され出力される。この出力信号を信号処理回路８に通して認識処理等を行い、その結果をインターフェース１１を介してパソコンに出力する。

【００１１】図３は本装置によって指紋を読みとる状況を模式的に示したものである。図３を用いて、窓部における指紋読取り時の光学的作用について詳細に説明する。窓部５に指１４を押し当てると、指紋の山の部分１５が光路７に密着し、指紋の谷の部分１６は光路７との間に隙間を作る。すなわち谷の部分では空気とプラスチックが接する状態となる。ＬＥＤ光源６から出て窓部５に照射された光線ａ、ｂ、ｃ、ｄのうち、指紋の山の部分すなわちプラスチックと指が密着している部分に照射された光ａ、ｃは吸収される。しかし、指紋の谷の部分、すなわち空気がプラスチックに接している部分に照射された光ｂ、ｄは、その入射角が全反射条件を満足するようにあらかじめ設計されていればプラスチックと空気の境界で全反射し、全反射光ｂ”、ｄ”として光路７内に戻り光路７の上下の反射面で多重反射しながらレンズ８のある受光側に導かれる。

【００１２】全反射条件については、空気の屈折率は１であるから、例えばプラスチックの屈折率を１．５とすると、窓部５への入射角の正弦ｓｉｎθが、１／１．５、すなわち２／３より大きい場合は、全反射条件を満たし境界面での全反射が生じる。すなわちこの条件を満たすように光源６の位置や角度を設計すれば、指紋の谷に照射された光は全反射する。厳密には、照明用ＬＥＤ等の光源６から出て窓部５に照射される光は所定の広がりをもっているので窓部５への入射角θにもばらつきがあるが、光軸の入射角が余裕をもって全反射条件を満たすように設計すれば、指紋の谷部と山部とで十分大きな反射光量比を確実に得ることができる。なお当然ながら、全反射光ｂ”、ｄ”が光路７の中を受光側方向に導かれるようにするため、光源６を、窓部５に対して受光側と反対の位置に配置している。

【００１３】次に紙面等の印刷物１７に印刷された文字や図形１８を読み取る装置の場合の光学的作用について図４を用いて説明する。まず図４（Ａ）のように、読み取り対象である印刷物とプラスチックとが完全に密着している場合、ＬＥＤ２からでた光線のうち、図形１８の白く印刷された部分１９に照射された光ｂ、ｄはほとんど散乱されて散乱光ｂ’、ｄ’として再びプラスチック内に戻り、黒く印刷された部分２０に照射された光ａ，ｃはそこで吸収されていしまうため散乱光を生じない。ただし反射率の違いに関わらず印刷物１７の表面では入射光と対称の方向に正反射が生じ、この正反射光は散乱光のレベルよりはるかに大きいため散乱光の強弱に含まれる情報を失わせる原因になる。このため図４（Ａ）では正反射が受光側に導かれないような入射角で照明光が照射されるようにしている。

【００１４】また図４（Ｂ）のように、読み取り対象とプラスチックの間に空気２１の層が存在する場合は、プラスチックと空気の界面を全反射せず透過した光ａ、ｂ、ｃ、ｄが印刷物１７の表面に照射され、図形１８のうち白く印刷された部分１９に照射された光ｂ、ｄの一部は散乱光ｂ’、ｄ’として再びプラスチック光路７内に戻り、さらにその一部は光路７内を反射しながら受光側に導かれる。黒く印刷された部分２０では反射率が低いため、照射された光ａ、ｃはほとんど吸収されてしまうことは同図（Ａ）の場合と同じである。

【００１５】また印刷物１７表面での正反射光が受光側に導かれないような配置をとる必要があることも、同図（Ａ）の場合と同様である。さらにこの例ではプラスチック光路７と空気２１が接しているため、照射された光がその界面で全反射する可能性がある。空気２１との界面で全反射すれば、印刷物１７に届かず効率が悪くなるだけでなく、大きなエネルギーを有する全反射光が受光側に導かれると全く白黒が判別できなくなる。この問題に対しても、同図（Ｂ）のように光路７と空気２１との界面に対する照射光の入射角を小さくとって全反射条件を回避したり、光源６の位置を窓部５に対して受光側寄りに取ることによって仮に全反射光が生じても受光側に導かれないようにすることで対応可能である。

【００１６】同図（Ａ）、（Ｂ）の例では、照射光ａ～ｄはほぼ境界面および印刷物１７の表面に対して垂直に入射しているので、印刷物１７表面からの正反射光は入射方向に向かって戻り、また境界面で全反射条件を満たす可能性は小さく仮に全反射が生じてもやはり入射方向に向かって戻るため、受光側に戻ることはない。この回避のための光源の配置は例えば図５に示すようなものである。図５では、光源６から出た光が窓部５に対して、ほぼ垂直かあるいは受光側の角度から入射するように光源６を窓部５に対して受光側寄りよりに配置している。この結果、全反射光ａ”、ｂ”は受光側に導かれることなく反対方向に放出され、受光側での白黒判別に悪い影響を与えることは無い。

【００１７】以上のように、凹凸のある指紋等を読みとる場合は界面での全反射光の有無を利用し、平板な印刷物上の白黒を判別するときは全反射光や正反射光を避けて散乱光を利用するという、光学作用の違いはあっても、いずれの場合も本願発明のような透明ブロックを光路とする基本的な構造は共通であり、いずれの場合も、窓部１からプラスチック平板の光路７に戻った光は、金

膜等を蒸着して形成した対向する反射面１１の間で反射を繰り返しながら伝搬し、結像用レンズ８でイメージセンサ９上に結像され、読みとり対象の情報を再現する。こうして、イメージセンサ９内で電気信号に変換された出力を取り出すことによって読みとり対象の情報を得ることができる。

【００１８】上記実施例では、結像レンズ８は、光路７を形成するプラスチック平板光路７の外部に配置したが、他の方法で結像レンズの光学的な機能を実現することも可能である。例えば、イメージセンサ９に対向する光路７の終端面を球面あるいは非球面のレンズ効果を持つような曲面とすることで、外部に結像レンズを持たなくても、イメージセンサ９上に光を結像させることができる。

【００１９】同様に、光路７を構成するプラスチック平板中の光線が通過する部分の屈折率分布を制御することによってプラスチック平板の内部にレンズ効果を生じさせることが可能であることも光学的には周知である。また、光路７は光学的に透明で一様な材質であれば良く、上記実施例では安価で量産の容易なプラスチック平板を用いたが、例えば光学ガラスを用いればより高精度の装置を実現することができる。

【００２０】

【発明の効果】本発明では光学的に透明なブロック平板から成る光路７の上下面を反射面として、光が両反射面の間を多重に反射しながら受光部に導かれるような構造をとることで、縮小光学系の設計に十分な光路長を確保しながら、光学系部分をカードのように薄くすることを可能にした。電気信号処理回路部分を薄型化することは周知の技術によっても比較的容易であるため、このように光学系部分を薄型化することにより、たとえばパソコンへのインタフェースの標準であるＰＣＭＣＩＡカードに準拠して製作することも可能となり、携帯可能な画像認識装置を実現することができる。

【００２１】またブロック平板の部材としてプラスチック平板を用いれば安価で量産に適したカード型イメージスキャナを実現することができる。とくに、本発明によるカード型画像認識装置を用いて指紋認識装置を実現し、銀行のキャッシュカード、クレジットカード、コンピュータへのアクセス用カード等として使用すれば、従来のようにセキュリティ管理を暗唱番号のみに依存するシステムに比べて、格段に優れたセキュリティ・システムを構築することができる。

【００２２】

【図面の簡単な説明】

【図１】図１は本発明によるカード型イメージスキャナの外観を示す。（Ａ）は平面図、（Ｂ）は側面図である。

【図２】図２は本発明によるカード型イメージスキャナの光学系部の構造を示す。

【図３】図３は本発明のカード型イメージスキャナによる指紋読取り状態を示す。

【図４】図４は本発明のカード型イメージスキャナによる印刷物の読取り状態を示し、（Ａ）は印刷物とプラスチックが密着している場合の図、（Ｂ）は印刷物とプラスチックの間に空気層がある場合の図を示す。

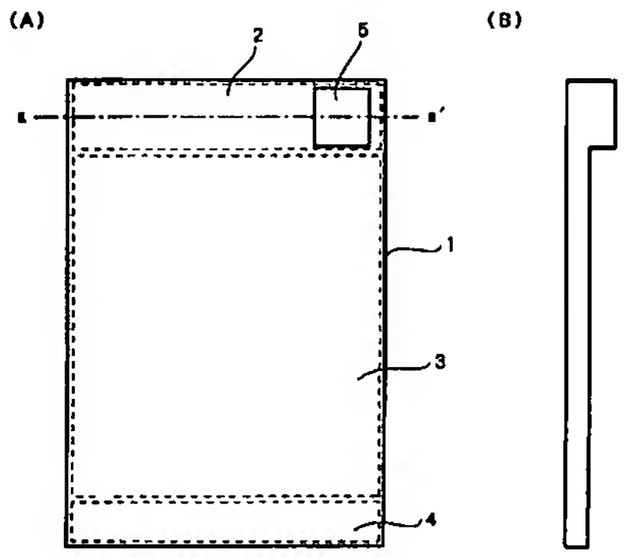
【図５】図５は正反射および全反射の回避のための配置例を示す。

【図６】図６は従来のイメージスキャナを用いた指紋読取り状態を示す。

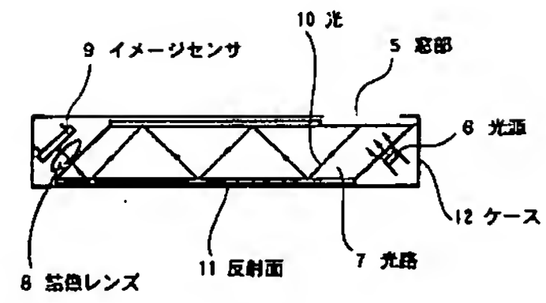
【符号の説明】

１　カード本体
２　光学系部
３　処理部
４　インタフェース
５　窓部
６　光源
７　光路
８　結像レンズ
９　イメージセンサ
１０　光
１１　反射面
１２　ケース
１３　プリズム
１４　指
１５　指紋の山部
１６　指紋の谷部
１７　印刷物
１８　印刷された図形
１９　白部
２０　黒部
２１　空気
ａ、ｂ、ｃ、ｄ　照射光
ｂ'、ｄ'　散乱光
ａ"、ｂ"、ｃ"、ｄ"　全反射光

【図1】



【図2】



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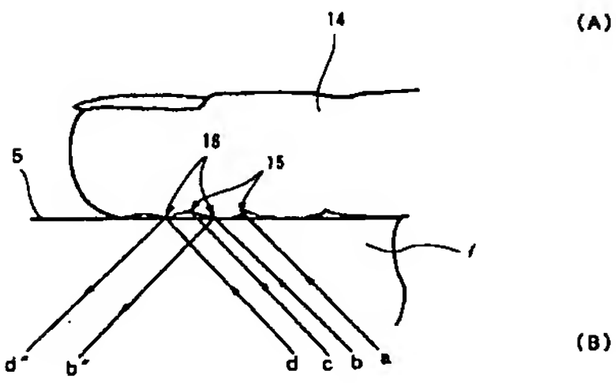
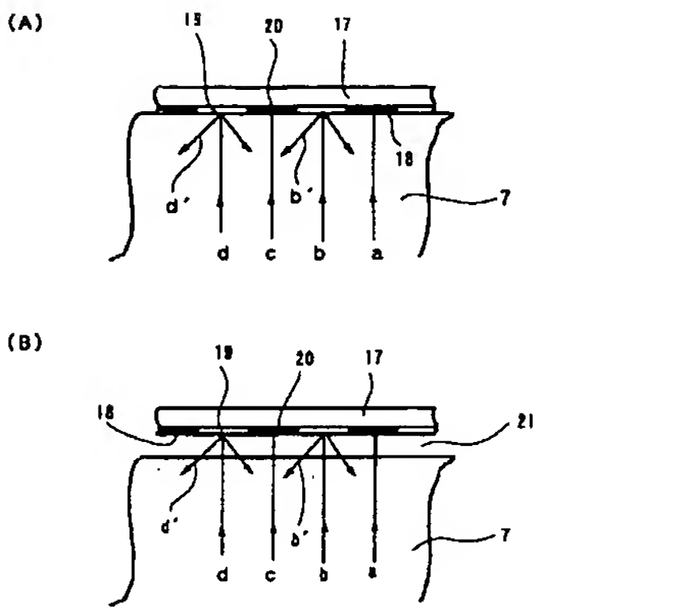
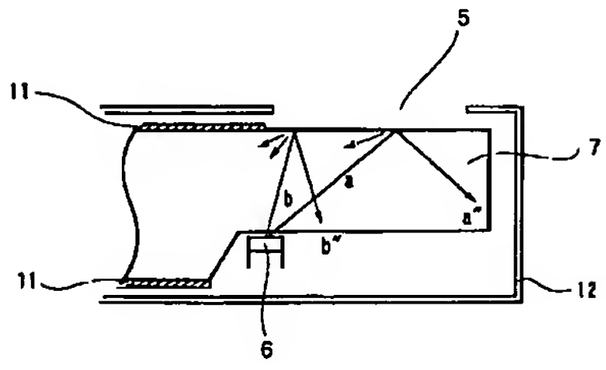


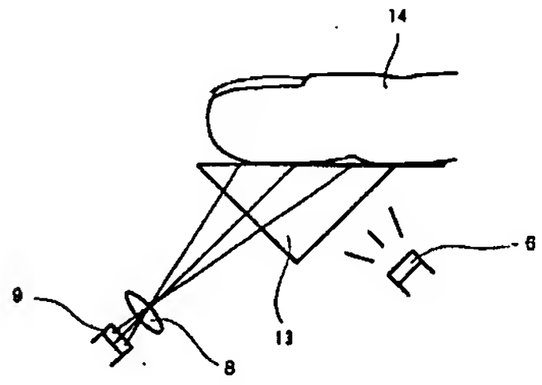
【図4】



【図5】



【図6】



PATENT ABSTRACTS OF JAPAN

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(21)Application number : 10-078190
(22)Date of filing : 26.03.1998

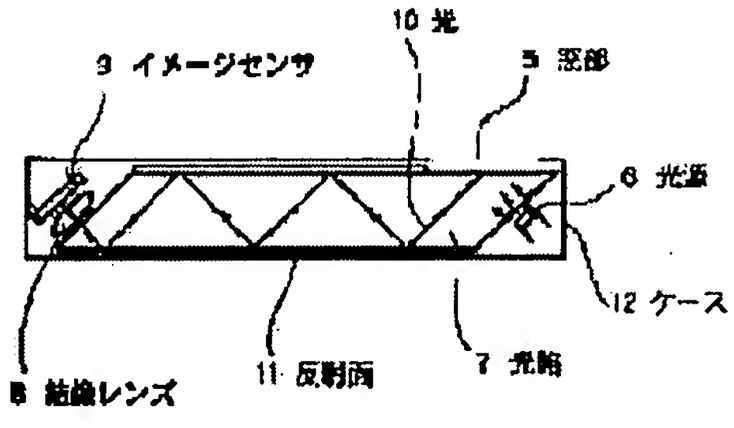
(71)Applicant : SUMITOMO ELECTRIC IND LTD
(72)Inventor : NISHIKAWA MITSURU

(54) IMAGE SCANNER

(57)Abstract:

PROBLEM TO BE SOLVED: To realize a thin type image scanner which is convenient to carry while securing optical path length needed to read the image of a fingerprint, etc.

SOLUTION: In this thin type image scanner, light emitted by a light source 6 to irradiate a window 5 is reflected while carrying information of a read object applied to the window 5, guided while being reflected by reflecting surfaces 11 formed on the top and reverse surfaces of an optical path 7 consisting of a transparent block, and imaged on an image sensor 9 by an image forming lens 8. Consequently, this scanner can be manufactured on the basis of a PCMCIA card being a standardized interface for a personal computer, and a portable image recognition device can be realized.



CLAIMS

[Claim(s)]
[Claim 1]A light source which irradiates a read object with illumination light, and an image sensor which receives catoptric light from a reading object and is changed into an electrical signal, An optical system to which an image sensor is made to carry out image formation of said catoptric light, and a memory measure which memorizes a signal read from an image sensor, It has a control means which controls said illumination light source, a memory measure, etc., and the optical path which made a reflector a portion except a window part which applies a read object at least among the upper and lower sides and which consists of a transparent block plate optically, An image scanner which spreading while light which reflected in said window part and returned to an inside of a block plate repeats reflection in the upper surface of a block plate, and a reflector at the bottom, and leading to said optical system.
[Claim 2]The image scanner according to claim 1 forming with a plastic a transparent block plate which constitutes an optical path of said optical system.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
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[Description of the Prior Art]Image recognition devices, such as an optical-character-recognition device, a bar code reader, and a fingerprint recognition device, had an illumination light source, a lens for image formation, and an image sensor, and they arrange them so that image formation of the reading object may be correctly carried out on an image sensor for suitable magnification.
[0003]The composition of the optical system of the fingerprint recognition device made comparatively small also in the above-mentioned conventional image recognition device is shown in drawing 6. Prism for LED for lighting and 13 whose 6 is a light source to bend an optical path, and 8 show the lens for image formation, and the finger an image sensor and whose 14 are the objects of fingerprint recognition as for 9, respectively. The light source 6 illuminates uniformly the portion which identifies the fingerprint on the prism 13. Although the state of reflection of this illumination light changes with unevenness of a fingerprint, fingerprint information is extracted by carrying out image formation of it on the image sensor 9 with the image formation lens 8.
[0004]
[Problem(s) to be Solved by the Invention]Usually, since the sizes of an image sensor are several [1/] to 1/tens compared with the size of read objects, such as a fingerprint, it must reduce for suitable magnification and image formation must be carried out to an image sensor. Since a design top is difficult for taking the extremely short interval of a lens and an image sensor, in order to obtain sufficient reducing magnification, light path length sufficient between a fingerprint reading station and an image sensor is needed. As a result, in structure like drawing 6, the thickness of a device and width become large, and since it is inconvenient also to a cellular phone, a use is also limited. this invention is made in view of the actual condition of the art of this conventional image recognition device, and comes out. The purpose cancels a fault and there is in providing the thin image scanner of the card shape which extends a use.

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[0006]By namely, a thing told to a light sensing portion by return [catoptric light] by using a block plate which makes a reflector where it is optically transparent and the upper and lower sides are parallel as an optical path while. Slimming down of a device is realized securing light path length of a request required for a reduction optical system as a whole. An invention of claim 2 is the card shape image scanner according to claim 1 realizing with a plastic a transparent block plate which constitutes an optical path of said optical system.
[0007]
[Embodiment of the Invention]The example of this invention is described with reference to drawing 1. The top view of the card shape image scanner whose (A) of drawing 1 is this example, and (B) are side views. In drawing 1, a card body and 2 show the optical system section inside a card, 3 shows a processing circuit part, and 1 shows an interface part 4.
[0008]Drawing 2 shows the a–a' section of the optical system section 2 in drawing 1 (A). The optical system section 2 comprised the light source 6, the optical path 7, the image formation lens 8, and the image sensor 9, and the case 12 has covered the circumference. However, in the window part 5, the optical path 7 was not covered in the case 12, and it has exposed outside. The light source 6 consists of LED of array form used for an area light. The optical path 7 comprises a block plate of a transparent plastic (for example, PMMA) optically, and lets a beam of light pass good to the inside. The upper and lower sides of the plastic plate which forms the optical path 7 are covered except for the portion equivalent to the window part 5 in the reflector 11 formed with the metal evaporated film etc., and form the good reflector. And no portions equivalent to the window part of a plastic plate and fields which counter the light source 6 and the lens 8 perform the surface treatment by a metal membrane, but are in the unreserved state of only flattening.
[0009]The light 10 which came out of LED which is the light source 6, and entered into the plastic of the optical path 7 illuminates the window part 5 uniformly. It reads in the plastic surface of the window part 5, and an object sets. Although the light 10 reflects in this window part, In that case, the inside of an optical path can be drawn repeating reflection further according to an optical mechanism which is mentioned later in the upper and lower sides of the optical path 7 reflecting desired information as power distribution of catoptric light, with the image formation lens 8, it is reduced for predetermined magnification and image formation is carried out on the image sensor 9. However, by a diagram, the light 10 reflected by a window part is represented only with one of the optic axes.
[0010]The image sensor 9 is a CCD sensor, a MOS sensor, etc. which arranged the optoelectric transducer in the shape of two dimensions. The light which carried out image formation to the image sensor 9 is changed and outputted to an electrical signal according to distribution of the strength. Recognition processing etc. are performed to the digital disposal circuit 8 through this output signal, and that result is outputted to a personal computer via the interface 11.
[0011]Drawing 3 shows typically the situation of identifying a fingerprint with this device. The optical effect at the time of fingerprint reading in a window part is explained in detail using drawing 3. If the finger 14 is pressed against the window part 5, the portion 15 of the mountain of a fingerprint will stick to the optical path 7, and the portion 16 of the valley of a fingerprint will make a crevice between the optical paths 7. Namely, in the portion of a valley, it will be in the state where a plastic touches air. The lights a and c irradiated by the portion which the portion of a mountain of a fingerprint, i.e., a plastic and a finger, has stuck among the beam of light a, b, and c to which it came out of LED source 6, and which was irradiated by the window part 5, and d are absorbed. However, the lights b and d irradiated by the portion of the valley of a fingerprint, i.e., the portion to which air is in contact with the plastic. It is led to the light-receiving side with the lens 8, carrying out total internal reflection to a plastic on the boundary of air, and carrying out a multiple echo in total-internal-reflection light b″ and the reflector of the upper and lower sides of the returned light way 7 as d″ in the optical path 7, if it is beforehand designed so that the incidence angle may satisfy a total reflection condition.
[0012]About a total reflection condition, since the refractive index of air is 1, if the refractive index of a plastic is set to 1.5, for example, sine sintheta of the incidence angle to the window

part 5 will fulfill a total reflection condition, when larger than 1/1.5, i.e., 2/3, and the total internal reflection in an interface will arise. That is, if the position and angle of the light source 6 are designed fulfill this condition, total internal reflection of the light irradiated by the valley of the fingerprint will be carried out. Since the light to which it comes out of the light sources 6, such as LED for lighting, and which is strictly irradiated by the window part 5 has predetermined breadth, the incidence angle theta to the window part 5 has dispersion, but. If it designs so that the incidence angle of an optic axis may fulfill a total reflection condition with a margin, a sufficiently big reflected-light-quantity ratio can be certainly obtained by the trough and peak parts of a fingerprint. Though natural, total-internal-reflection light b″ and in order to lead the inside of the optical path 7 to d″ in a light-receiving side direction, the light source 6 is arranged in the position opposite to the light-receiving side to the window part 5.

[0013]Next, the optical effect in the case of the device which reads the character printed by the printed matter 17, such as space, and the figure 18 is explained using drawing 4. When the printed matter and plastic which are reading objects have stuck thoroughly like drawing 4 (A) first, The scattered light is not produced, in order to almost scatter about the lights b and d irradiated by the portion 19 by which the figure 18 was printed white among the beams of light which came out of LED2, to absorb there scattered-light b' and the lights a and c irradiated by the portion 20 which returned in the plastic again as d' and was printed black and to keep. However, it is not concerned with the difference in reflectance, but on the surface of the printed matter 17, regular reflection arises in incident light and the symmetrical direction, and since this regular reflection light is far larger than the level of the scattered light, it becomes the cause of making the information included in the strength of the scattered light losing. For this reason, he is trying to irradiate the illumination light in drawing 4 (A) according to an incidence angle which is not led to the regular reflection's light-receiving side.

[0014]When the layer of the air 21 exists between a reading object and a plastic like drawing 4 (B), The light a, b, and c which did not carry out total internal reflection of the interface of a plastic and air, but penetrated it, and d are irradiated by the surface of the printed matter 17, A part of lights b and d irradiated by the portion 19 printed white among the figures 18 return in the plastic optical path 7 again as scattered-light b' and d', and the part is further led to the light-receiving side, reflecting the inside of the optical path 7. It is the same as that of the case of the figure (A) that almost will be absorbed of the lights a and c irradiated in the portion 20 printed black since reflectance was low.

[0015]It is the same as that of the case of the figure (A) that it is necessary to take arrangement which is not led to the regular reflection light's in the printed matter 17 surface light-receiving side. Furthermore, in this example, since the air 21 is in contact with the plastic optical path 7, the irradiated light may carry out total internal reflection according to that interface. When the total-internal-reflection light which does not reach the printed matter 17 but efficiency not only worsens, but has big energy is led to the light-receiving side, it becomes impossible to completely distinguish black and white, if total internal reflection is carried out by an interface with the air 21. Also to this problem, as shown in the figure (B), take the small incidence angle of the irradiation light to the interface of the optical path 7 and the air 21, avoid a total reflection condition, or, It can respond by making it not led to the light-receiving side, even if total-internal-reflection light arises by taking the position of the light source 6 to the light-receiving side slippage to the window part 5.

[0016]In the example of the figure (A) and (B), since irradiation light a-d has entered vertically to an interface and the surface of the printed matter 17 mostly, Since a possibility of the regular reflection light from the printed matter 17 surface returning toward an incidence direction, and fulfilling a total reflection condition by an interface will return toward an incidence direction too even if total internal reflection arises small, it does not return to the light-receiving side. It seems that arrangement of the light source for this evasion is shown in drawing 5. In drawing 5, to the window part 5, the light which came out of the light source 6 is almost vertical, or it arranges the light source 6 to the window part 5 for a light-receiving side to come together and depend so that it may enter from the angle by the side of light-receiving. As a result, b″ is emitted to a counter direction, without being led to the light-receiving side, and it does not have [total-internal-reflection light a″ and] bad influence on monochrome distinction by the side of

light-receiving.
[0017]As mentioned above, when identifying an irregular fingerprint etc., using the existence of the total-internal-reflection light in an interface and distinguishing black and white on monotonous printed matter, even if there is a difference in an optical work of avoiding total-internal-reflection light and regular reflection light, and using the scattered light, The light with which a fundamental structure which makes an optical path a transparent block [like the invention in this application] in which any case is is common, and it returned from the window part 1 to the optical path 7 of the plastic plate in any case, It spreads repeating reflection between the reflectors 11 which vapor-deposited and formed the metal membrane etc. and which counter, image formation is carried out on the image sensor 9 with the lens 8 for image formation, and the information for reading is reproduced. In this way, it can read by taking out the output changed into the electrical signal within the image sensor 9, and the target information can be acquired.
[0018]Although the image formation lens 8 has been arranged in the above-mentioned example to the exterior of the plastic plate optical path 7 which forms the optical path 7, it is also possible to realize the optical function of an image formation lens by other methods. For example, by making the end face of the optical path 7 which counters the image sensor 9 into a curved surface which has a lens effect of a surface of a sphere or an aspheric surface, even if it does not have an image formation lens outside, image formation of the light can be carried out on the image sensor 9.
[0019]It is common knowledge optically that it is also possible to make the inside of a plastic plate produce a lens effect by controlling the refractive index distribution of the portion which similarly the beam of light in the plastic plate which constitutes the optical path 7 passes. Although the optical path 7 should just be transparent and uniform construction material optically, it was cheap and the easy plastic plate of mass production was used in the above-mentioned example, if optical glass is used, for example, a highly precise device is realizable.
[0020]
[Effect of the Invention]It made it possible to make an optical system section thin like a card, securing light path length sufficient by taking structure which is led to a light sensing portion, while light reflects between both reflectors in multiplex by making into a reflector the upper and lower sides of the optical path 7 which comprises a transparent block plate optically in this invention for the design of a reduction optical system. Slimming down an electrical signal processing circuit portion also by well-known art Since it is comparatively easy, Thus, by slimming down an optical system section, it also becomes possible to manufacture based on the PCMCIA card which is a standard of an interface in a personal computer, for example, and a portable image recognition device can be realized.
[0021]If a plastic plate is used as a member of a block plate, it is cheap and a card shape image scanner suitable for mass production can be realized. If a fingerprint recognition device is realized using the card shape image recognition device by this invention and it is especially used as the ATM card of a bank, a credit card, a card for access to a computer, etc., compared with the system which depends for a security management only on a recitation number like before, the security system which was markedly alike and was excellent can be built.
[0022]

[Translation done.]

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(21)Application number : 10-078190
(22)Date of filing : 26.03.1998

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(72)Inventor : NISHIKAWA MITSURU

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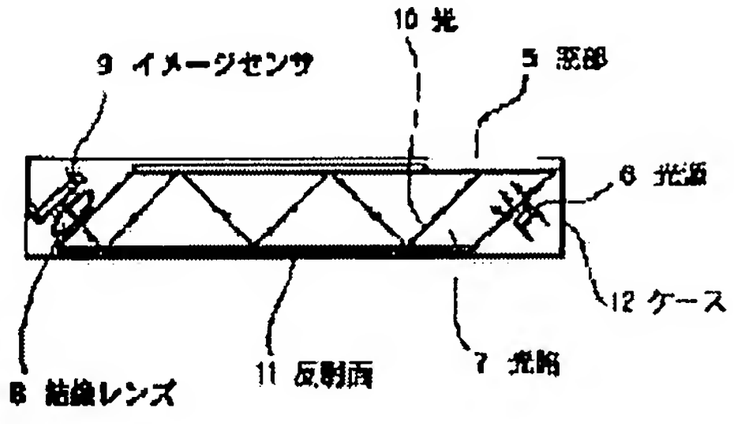

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part 5 will fulfill a total reflection condition, when larger than 1/1.5, i.e., 2/3, and the total internal reflection in an interface will arise. That is, if the position and angle of the light source 6 are designed fulfill this condition, total internal reflection of the light irradiated by the valley of the fingerprint will be carried out. Since the light to which it comes out of the light sources 6, such as LED for lighting, and which is strictly irradiated by the window part 5 has predetermined breadth, the incidence angle theta to the window part 5 has dispersion, but. If it designs so that the incidence angle of an optic axis may fulfill a total reflection condition with a margin, a sufficiently big reflected-light-quantity ratio can be certainly obtained by the trough and peak parts of a fingerprint. Though natural, total-internal-reflection light b″ and in order to lead the inside of the optical path 7 to d″ in a light-receiving side direction, the light source 6 is arranged in the position opposite to the light-receiving side to the window part 5.

[0013]Next, the optical effect in the case of the device which reads the character printed by the printed matter 17, such as space, and the figure 18 is explained using drawing 4. When the printed matter and plastic which are reading objects have stuck thoroughly like drawing 4 (A) first, The scattered light is not produced, in order to almost scatter about the lights b and d irradiated by the portion 19 by which the figure 18 was printed white among the beams of light which came out of LED2, to absorb there scattered-light b' and the lights a and c irradiated by the portion 20 which returned in the plastic again as d' and was printed black and to keep. However, it is not concerned with the difference in reflectance, but on the surface of the printed matter 17, regular reflection arises in incident light and the symmetrical direction, and since this regular reflection light is far larger than the level of the scattered light, it becomes the cause of making the information included in the strength of the scattered light losing. For this reason, he is trying to irradiate the illumination light in drawing 4 (A) according to an incidence angle which is not led to the regular reflection's light-receiving side.

[0014]When the layer of the air 21 exists between a reading object and a plastic like drawing 4 (B), The light a, b, and c which did not carry out total internal reflection of the interface of a plastic and air, but penetrated it, and d are irradiated by the surface of the printed matter 17, A part of lights b and d irradiated by the portion 19 printed white among the figures 18 return in the plastic optical path 7 again as scattered-light b' and d', and the part is further led to the light-receiving side, reflecting the inside of the optical path 7. It is the same as that of the case of the figure (A) that almost will be absorbed of the lights a and c irradiated in the portion 20 printed black since reflectance was low.

[0015]It is the same as that of the case of the figure (A) that it is necessary to take arrangement which is not led to the regular reflection light's in the printed matter 17 surface light-receiving side. Furthermore, in this example, since the air 21 is in contact with the plastic optical path 7, the irradiated light may carry out total internal reflection according to that interface. When the total-internal-reflection light which does not reach the printed matter 17 but efficiency not only worsens, but has big energy is led to the light-receiving side, it becomes impossible to completely distinguish black and white, if total internal reflection is carried out by an interface with the air 21. Also to this problem, as shown in the figure (B), take the small incidence angle of the irradiation light to the interface of the optical path 7 and the air 21, avoid a total reflection condition, or, It can respond by making it not led to the light-receiving side, even if total-internal-reflection light arises by taking the position of the light source 6 to the light-receiving side slippage to the window part 5.

[0016]In the example of the figure (A) and (B), since irradiation light a-d has entered vertically to an interface and the surface of the printed matter 17 mostly, Since a possibility of the regular reflection light from the printed matter 17 surface returning toward an incidence direction, and fulfilling a total reflection condition by an interface will return toward an incidence direction too even if total internal reflection arises small, it does not return to the light-receiving side. It seems that arrangement of the light source for this evasion is shown in drawing 5. In drawing 5, to the window part 5, the light which came out of the light source 6 is almost vertical, or it arranges the light source 6 to the window part 5 for a light-receiving side to come together and depend so that it may enter from the angle by the side of light-receiving. As a result, b″ is emitted to a counter direction, without being led to the light-receiving side, and it does not have [total-internal-reflection light a″ and] bad influence on monochrome distinction by the side of

light-receiving.
[0017]As mentioned above, when identifying an irregular fingerprint etc., using the existence of the total-internal-reflection light in an interface and distinguishing black and white on monotonous printed matter, even if there is a difference in an optical work of avoiding total-internal-reflection light and regular reflection light, and using the scattered light, The light with which a fundamental structure which makes an optical path a transparent block [like the invention in this application] in which any case is is common, and it returned from the window part 1 to the optical path 7 of the plastic plate in any case, It spreads repeating reflection between the reflectors 11 which vapor-deposited and formed the metal membrane etc. and which counter, image formation is carried out on the image sensor 9 with the lens 8 for image formation, and the information for reading is reproduced. In this way, it can read by taking out the output changed into the electrical signal within the image sensor 9, and the target information can be acquired.
[0018]Although the image formation lens 8 has been arranged in the above-mentioned example to the exterior of the plastic plate optical path 7 which forms the optical path 7, it is also possible to realize the optical function of an image formation lens by other methods. For example, by making the end face of the optical path 7 which counters the image sensor 9 into a curved surface which has a lens effect of a surface of a sphere or an aspheric surface, even if it does not have an image formation lens outside, image formation of the light can be carried out on the image sensor 9.
[0019]It is common knowledge optically that it is also possible to make the inside of a plastic plate produce a lens effect by controlling the refractive index distribution of the portion which similarly the beam of light in the plastic plate which constitutes the optical path 7 passes. Although the optical path 7 should just be transparent and uniform construction material optically, it was cheap and the easy plastic plate of mass production was used in the above-mentioned example, if optical glass is used, for example, a highly precise device is realizable.
[0020]
[Effect of the Invention]It made it possible to make an optical system section thin like a card, securing light path length sufficient by taking structure which is led to a light sensing portion, while light reflects between both reflectors in multiplex by making into a reflector the upper and lower sides of the optical path 7 which comprises a transparent block plate optically in this invention for the design of a reduction optical system. Slimming down an electrical signal processing circuit portion also by well-known art Since it is comparatively easy, Thus, by slimming down an optical system section, it also becomes possible to manufacture based on the PCMCIA card which is a standard of an interface in a personal computer, for example, and a portable image recognition device can be realized.
[0021]If a plastic plate is used as a member of a block plate, it is cheap and a card shape image scanner suitable for mass production can be realized. If a fingerprint recognition device is realized using the card shape image recognition device by this invention and it is especially used as the ATM card of a bank, a credit card, a card for access to a computer, etc., compared with the system which depends for a security management only on a recitation number like before, the security system which was markedly alike and was excellent can be built.
[0022]

[Translation done.]